PRODUCT SPECIFICATION

13.76Kwh / 6.9Mw Energy Storage System

Pack design	Pack process	Pack approval	Cell approval	QA. approval	Sales approval

Client Approval	Signature：	Date：
	Company Code：	
	Company Stamp：	

Confidential ： ○ Level 3 ○ Level 2 (√) Level 1

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1.Summary

1.1.Scope of application

This specification provides a detailed description of the performance indicators, parameter thresholds, product usage conditions, and risk warnings of 280Ah rechargeable lithium iron phosphate prismatic cells, battery modules, battery clusters, battery system liquid cooling units, BMS, and other applications in large-scale energy storage container systems produced by Orient Power.

Note: The specifications shall be defined in Chinese.

1.2.Design criteria

The design standards of Orient Power battery comply with the national standards of the People's Republic of China (GB) and the power industry standards of the People's Republic of China (DL) and CE The main referenced standards areas follows：

Certificate.

GB/T 13384-2008	General specification for packaging of mechanical and electrical products
GB/T 191-2008	Pictoral marks for packaging, storage and transportation
GB/T 2423.1-2008	Enviromental testing of electric and electronic products Part 2: Test methods A: low temperature
GB/T 2423.2-2008	2: B: Environmental testing of electric and electronic products Part 2: Test methods test B: high temperature
GB 4208-2008	Enclosure protection class (IP code)
GB/T 36276-2018	Lithium ion batteries for electric energy storage
GB 34131-2017	Management system for electric energy storage
GB/T34120-2017	Technical specifications for electrochemical energy storage system, energy storage inverters
GB/T 34133-2017	Technical specifications for testing energy storage inverters

2.System scheme

2.1.Design scheme

The 3.2V/280Ah lithium iron phosphate prismatic battery cell manufactured is used in this scheme. The battery system consists of 1P384S * 10 clusters, each containing 8 1P48S battery modules, and each module containing 4 1P12S modules. The battery management system inside the box uses high-precision BMS to collect and monitor data from the battery pack. The BMS has external communication function and is compatible with the supporting PCS, HMI, EMS, and water cooler Firefighting and other equipment can transmit data and operate safely and stably for a long time.

The AC side is connected to the grid on the 10kV/35kV side using a 3450kW boost inverter module through the transformer output. A grid-level EMS (Energy Management System) is used, which is mainly responsible for monitoring and executing charging and discharging strategies to optimize the operational efficiency of the energy storage system.

According to the TCEC373-2020 standard, the fire separation distance between each prefabricated compartment should be greater than 3 meters. When using a firewall, the fire separation distance is not limited.

One energy storage unit needs to build a water storage tank, which is used as the water intake point for the water fire protection system. Lightning protection towers should be arranged around it, and the number should be based on the coverage range. They should be connected to the underground network together with the grounding point of the prefabricated cabin.

This program adopts every two 3.44MWh containers configured with a 3450kW boost inverter integrated cabin, each 3450kW boost inverter consist 2 set of 1725kW PCS, through the transformer output voltage of 10kV or 35kV, the system operates at a multiplication rate of 0.5C.

The topology diagram is as follows：

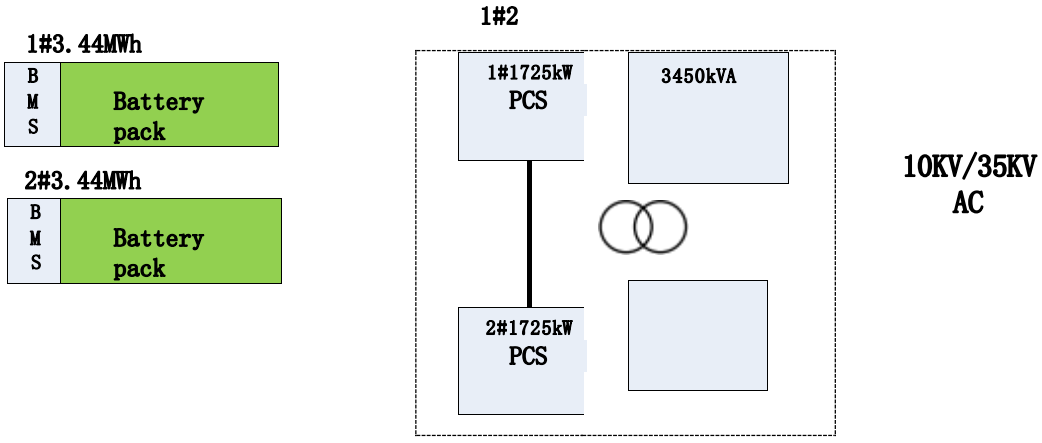


Fig. 2.1 Topological diagram of 3.44MWh system

System Component:

Battery Pack

A battery pack is the core part of an energy storage system and consists of multiple battery cells used to store and release electrical energy.

Battery Management System (BMS)

The BMS is responsible for monitoring, managing and controlling the battery pack to ensure its safety and performance. It has the functions of battery status monitoring, temperature control, battery charging and discharging protection and equalization, etc. It can discover and solve the problems in the operation of the battery pack in time, and improve the reliability and stability of the system.

EMS

Responsible for monitoring and controlling the operation of the energy storage system, EMS is able to carry out charging and discharging control according to the feedback information, optimize the scheduling and energy management of the battery pack, and ensure the safe and stable operation of the energy storage system.

PCS

PCS is a bi-directional converter, which can realize the bi-directional energy transfer between AC grid powerand storage battery power. This means that it can convert AC power from the grid into DC power to charge the battery, and it can also convert the DC power in the battery into AC power to supply the grid or users.

Transformer

Its main function is to regulate the AC voltage of electrical energy during transmission, distribution and utilization. In the energy storage system, the transformer can convert the electric energy into the appropriate voltage according to the actual needs to ensure the normal operation of the energy storage system.

Function Description:

Grid-connected mode:

1) The energy storage system ingrid-connected mode mainly plays the role of peakshaving and emergency backup. During the peak load period of the grid, the energy storage equipment can release power to reduce the pressure on the grid; charge during the trough of the grid tariff and discharge during the peak in order to optimize the electricity expenditure.

Off-grid mode:

1) When the grid fails or needs to be operated off the grid, the energy storage system forms an independent power supply system that does not rely on the grid for power supply to meet load demand.

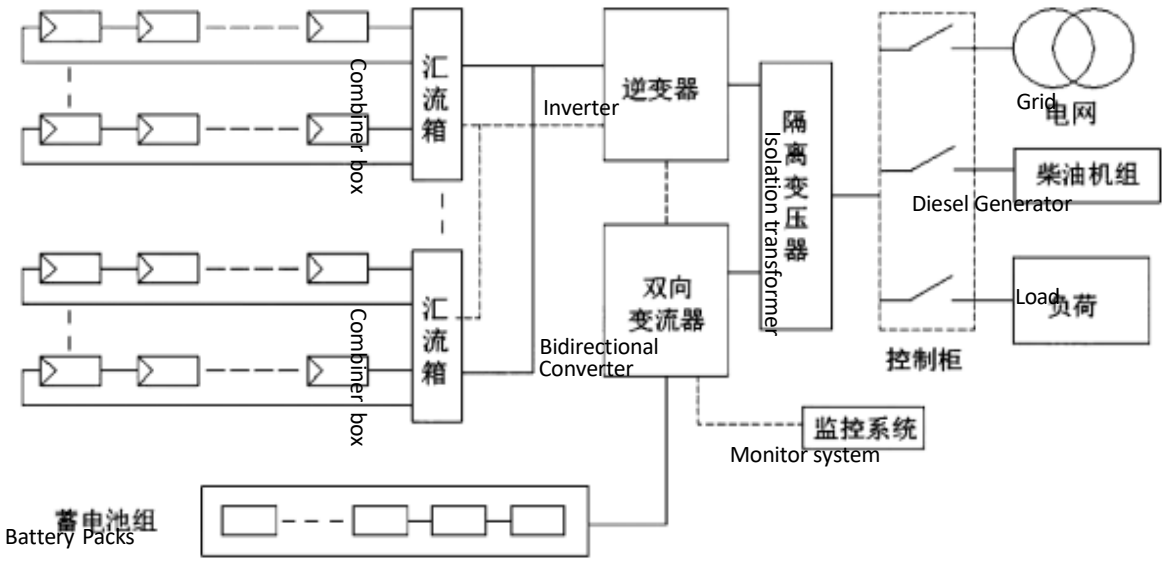


Fig. 2.3 topological diagram of system(for reference only)

2.2.Configuration

According to the standard battery module, Orient Power designs the standard 20-foot container energy storage system 6058*2438*2896mm, with a total power distribution capacity of 13.76MWh.There are 4 sets of 3.44MWh prefabricated pods and 2 sets of 3450kW boost inverter integrated pods, every 2 sets of prefabricated pods are configured with 1 set of boost inverter integrated pods, and every boost inverter integrated pod contains 2 sets of 1725kW PCS and 1 set of 3450kW transformer.

Table 2.2-1 20 foot container system configuration table

Type	Model	Voltage min	Voltage max	Voltage rated	Energy	Quantity
Cell	280Ah	2.8	3.55	3.2	896	3840
Pack	1P48S	134.4	170.4	153.6	43008	80
Cluster	1P384S	1075.2	1363.2	1228.8	344064	10
System	10P384S	1075.2	1363.2	1228.8	3440640	1

3.System parameter

3.1.Monomer cell

The following chart shows the main parameters of the cell:

Table 3.1 280Ah cell parameters

NO.	Name		Product specification	Condition
1	Cell capacity		≥280Ah	2.8~3.55V, 25±2℃0.5C discharge current, new battery state.
2	Working voltage		2.8~3.55V	N.A
3	Internal resistance （1kHz）		≤0.25mΩ	Refer to the specification of electric core for details
4	Operating temperature (charging)		0~55℃	Refer to the specification of electric core for details
5	Operating temperature (Discharging)		-20~55℃	Refer to the specification of electric core for details
6	Weight		5.56±0.2kg	N.A
7	Standard operating current		140A	25 ± 2 ℃ ambient temperature
8	Max. sustainable operating current		280A	25 ± 2 ℃ ambient temperature
9	Storage temperature	Months	-30℃-45℃	SOC: 25% -40% Storage environment humidity ≤ 85% RH, no condensation
		Months	-20℃-35℃	
10	Monthly self discharge rate		≤3.5% month	25°C, 50% SOC, after 3 months of new battery storage
11	Cell dimension		(71.8*207.1*174.2）±0.8mm	300±20kg.f

3.2.Pack

The battery module consists of four standard modules connected in series
The following chart shows the main parameters of the battery module

Table 3.2 280Ah battery box parameter list

NO.	Name	Product specification	Condition
1	Combination mode	1P48S	N.A
2	Nominal voltage	153.6V	N.A
3	Voltage range	134.4~170.4V	Monomer protection 2.8 to 3.55V
4	Nominal energy	43.008kWh	25℃±2
5	Standard operating current	140A	N.A
6	MAX. operating current	155A	25℃±2
7	Installation mode	Plugin box type	N.A
8	Charging temperature	0~55℃	N.A
9	Discharging temperature	-10~55℃	N.A
10	Cooling mode	liquid-cooled	N.A
11	Battery pack dimension	See below	N.A
12	Box weight	≤340kg	N.A
13	protection grade	IP65	N.A

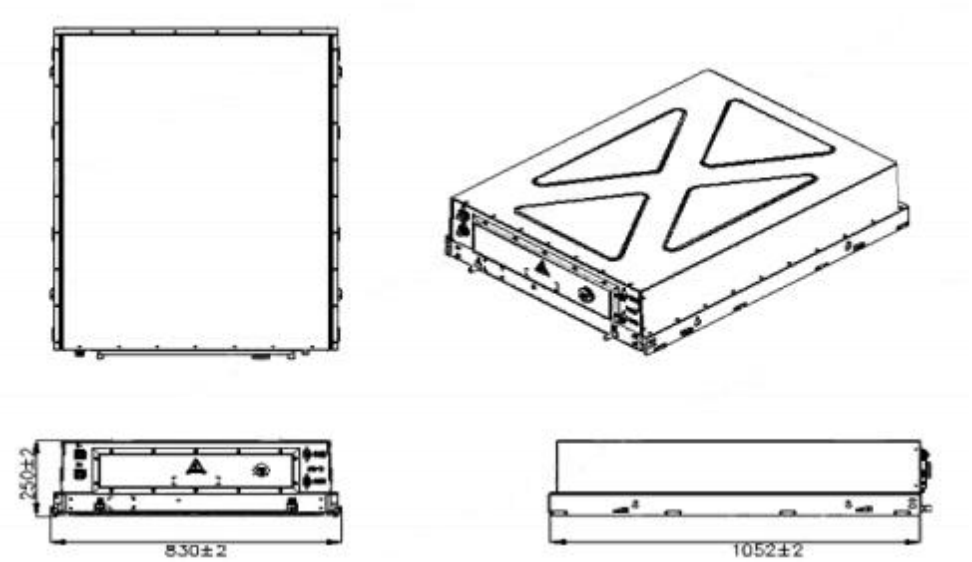


Fig. 3.2-1 Schematic diagram of battery box (for reference only)

3.3. Battery cluster

The battery cluster consists of 8 battery modules connected in series, a high-voltage box, and other wiring harness accessories.

The following chart shows the main parameters of a standard battery cluster:

Table 3.3 Standard battery cluster parameter

NO.	Name	Product specification	Condition
1	Combination mode	1P384S	N.A
2	Nominal voltage	1228.8V	N.A
3	Voltage range	1075.2~1363.2V	Monomer protection 2.8 to 3.55V
4	Nominal energy	344.064kWh	25℃±2
5	Standard operating current	140A	N.A

6	MAX. operating current	155A	25℃±2
7	Charging temperature	0~55℃	N.A
8	Discharging temperature	-10~55℃	N.A
9	Cooling mode	liquid-cooled	N.A
10	Battery rack dimension	See below	N.A
11	Single cluster weight	≤3100kg	N.A

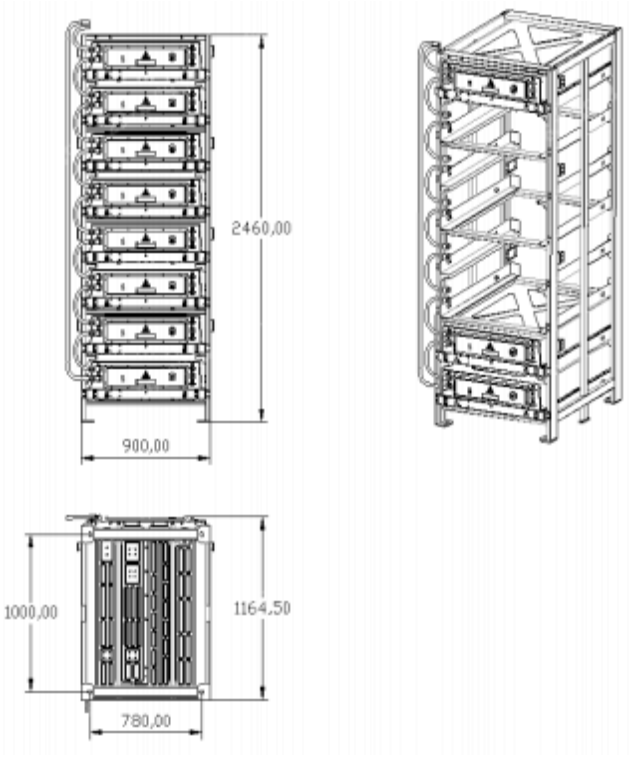


Fig. 3.3-1 Schematic diagram of battery cluster (for reference only)

3.4. Battery System

The following is the layout of a 20 foot container system: built-in 10 * 1P384S battery cluster, 1 combiner cabinet, 1 water cooler, 1 fire protection system, 1 environmental control air conditioning system, 1 temperature and humidity control system, 1 lighting system, 1 exhaust system, etc.

Fig. 3.4-1 20 ft container layout diagram (for reference only)



3.5.High Voltage Box

Each battery cluster contains one high-voltage box, which is mainly responsible for voltage and current collection of the battery cluster, summarizing the voltage and temperature information of individual batteries within the cluster, calculating the SOC/SOH status of the battery cluster, executing balancing strategy judgment and battery fault diagnosis functions, and implementing on-site protection and relay control of the battery cluster based on battery fault information. The high-voltage box has a communication interface, which can achieve data communication with the battery management unit (BAU) and battery array management unit (EMS).
BMS has functions such as insulation collection and individual SOC/SOH state calculation.

3.5.1 Parameter table of high voltage box

The parameters of high voltage box areas follows ：

Table 3.5 1 Parameter table of high voltage box

NO.	Name	Describe
1	Main components	BCU, relay, fuse, shunt, etc
2	Panel device	Air switch, circuit breaker, 220 V AC interface, etc
3	Protection function	System protection, insulation / total voltage detection, etc
4	IP	IP2X
5	Installation mode	Plugin box

3.5.2.External interface

The definition of external interface of high voltage box is as follows ：

Table 3.6 2 external interface of high voltage box

NO.	Name	Describe	Remarks
1	High voltage input positive	BAT+	N.A
2	High voltage input negative	BAT-	N.A
3	AC input	220Vac	N.A
4	Inter box communication	BCU-BMU	N.A
5	External communication	BCU-BAU	N.A
6	High voltage output positive	PCS+	N.A
7	High voltage output negative	PCS-	N.A
8	Ground point	M6 screw	N.A

3.6.HMI

Each energy storage system is equipped with a 10 inch display screen, which is used to display the main parameters such as the operating status and alarm information of all battery clusters under the overall control.

The main parameters of the display areas follows ：

Table 3-6 Display parameters

NO.	Name	Describe	Remarks
1	Dimensions and specifications	10-inch color touchscreen	N.A
2	Power supply mode	DC24V	N.A
3	Communication mode	RS485	N.A
4	Running state	Stop, standby, charging, discharging, fault, emergency stop, etc	N.A
5	Alarm information	Overcharge, over discharge,over current, over temperature, insulation fault, communication fault, self check fault, etc	N.A
6	Main parameter	SOC,total voltage, total current, maximum and minimum cell voltage, maximum and minimum temperature, etc	N.A
7	Display parameters	With the battery cluster details button, click to open the corresponding details page. The battery cluster details display the operation status, alarm information, SOC, total voltage, total current, insulation resistance value, maximum cell voltage difference, maximum temperature, all cell voltages, all temperature measurement values, and make special marks for the maximum cell voltage, minimum cell voltage, maximum temperature and other parameters.	N.A
8	Settings window	Display window, setting window, history record, etc.	N.A
9	Storage function	Historical data can be stored and read by SD card.	N.A
10	Installation	Combiner cabinet panel	N.A

4.Water cooling system

4.1.Describe

Containerized battery pack water cooler is air-cooled chiller. Outside the machine side through the fan will release heat into the air, the unit internal compressor refrigeration system through the heat exchanger and the refrigerant glycol solution heat exchange, computer control system through the upper computer and the unit of water temperature and pressure of the feedback signal logic control system output temperature, the water system based on the main line and the battery module resistance configuration of the circulating water pump, the system to control the module refrigerant (glycol solution) in and out of the module flow. Each battery prefabrication compartment is equipped with a water-cooled machine. The liquid cooling unit is equipped with a comprehensive anti condensation, anti leakage liquid and automatic liquid replenishment design.

1. The liquid cooling tube is wrapped in anti condensation foam to effectively prevent water droplets and condensation from damaging the battery pack.

2. After the installation of the liquid cooling pipe, an airtightness test will be carried out. Only after passing the test can the liquid be injected for operation. There is a pressure monitoring gauge at the inlet and outlet of the unit, and the pressure inside the pipe during the operation and static state of the liquid cooling unit will be detected. When the pressure value is abnormal, an alarm will be triggered and information will be reported to the monitoring platform.

3. Each prefabricated compartment is equipped with two sets of sensitivity adjustable water immersion transmitters and probes at the bottom. The transmitters are equipped with RS485 communication function, which can quickly detect the leakage situation and report alarm signals and monitoring platforms in case of leakage.

4. The system has the function of automatically replenishing coolant. The additional stored coolant tank is connected to the main pipeline and isolated with a water stop valve in the middle. When the pressure gauge of the unit detects a liquid leak, the system will automatically open the water stop valve, and the main pipeline will suck in the stored coolant until the pressure value is normal, which can reduce the maintenance frequency of operation and maintenance personnel.

4.2.Parameter table

This project is equipped with a water-cooled machine with the following parameters:

Table 4-1 Parameter table

NO.	Name	Unit	Remarks
1	Working voltage	-	380Vac
2	Cryogen	-	R134A/R410A
3	Refrigerant carrier	-	50% pure water+50% glycol
4	Automatic flurd replenishment function	L	≥8L
5	Communication protocol	-	RS485
6	Noise	dB	≤78
7	Protection grade	-	IPX5
8	Anti-corrosion grade	-	C3

9	Operating ambient temperature	℃	-30~55℃

5. BMS

5.1.Topological graph

The battery management of the system adopts a three-level BMS architecture, which enables control management to achieve corresponding functions and ensure system stability and reliability.

BMU battery cell management unit: responsible for collecting information on each cell of the battery (voltage, temperature), providing calculation and analysis of the battery's SOC and SOH parameters, achieving balance of individual cells, and uploading abnormal information of individual cells to the battery cluster unit BCU.

BCU battery cluster management unit: responsible for collecting various individual battery information uploaded by BMU, and collecting various information of battery pack (group voltage, group temperature).

Calculate and analyze the SOC and SOH of the battery pack, including charging and discharging currents, and battery pack status, and uploading all information to PCS and EMS for battery status management. It can communicate with peripheral devices.

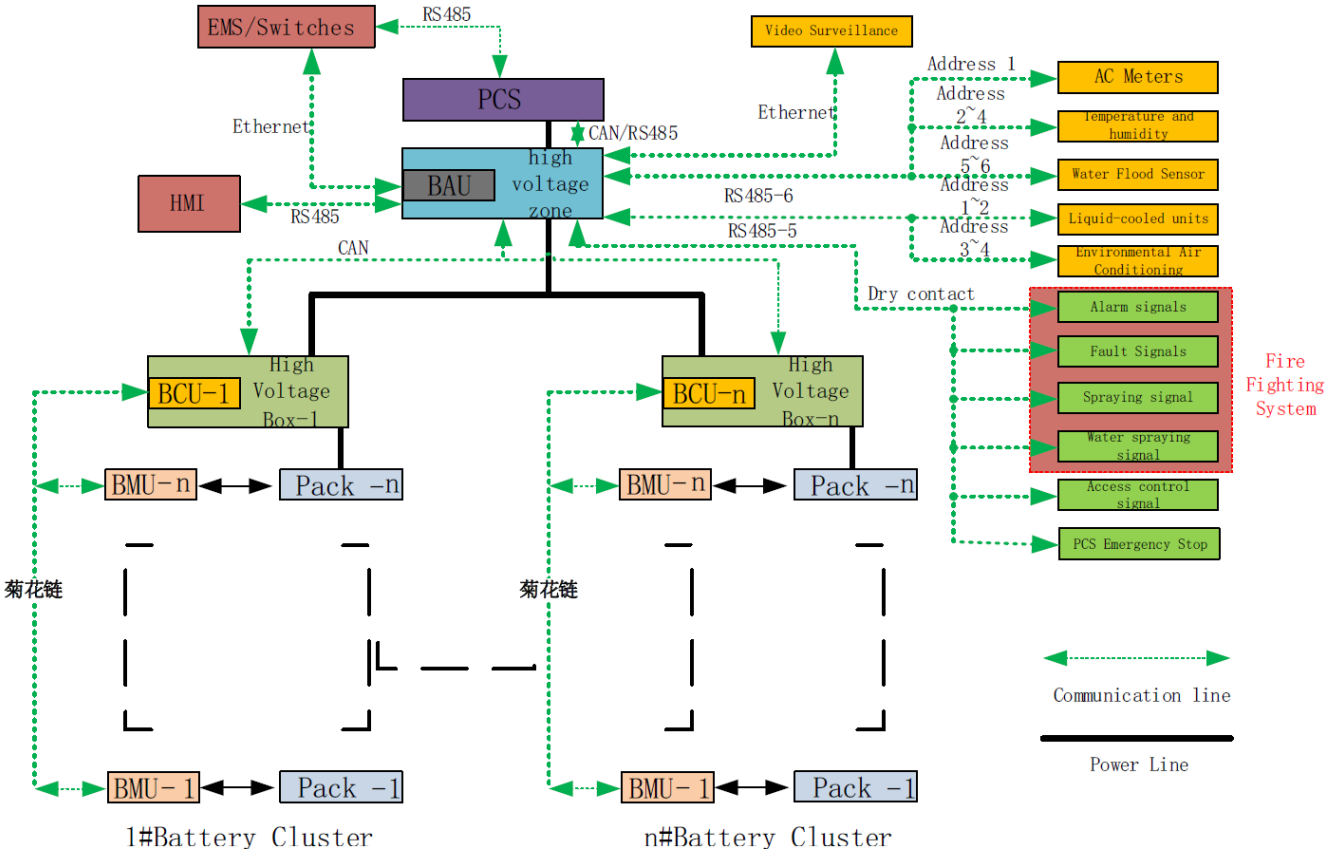


Fig. 5.1 topological diagram of BMS system

BAU Battery Pack Management Unit: mainly responsible for collecting various battery information uploaded by BCU, controlling the charging and discharging of the system based on the current working conditions and battery pack status, and uploading all information to PCS and EMS for battery status management. It can communicate with peripheral devices.

The battery management system is a real-time monitoring system composed of electronic circuit devices, which can effectively monitor battery voltage, battery current, battery cluster insulation status, battery SOC, manage

system charging and discharging safety, alarm and emergency protection for possible faults, optimize control of the battery system, and ensure safe, reliable, and stable operation of the battery.

5.3.BMS Parameters and configuration values

The battery management system consists of a battery cell management unit (BMU), a battery cluster management unit (BCU), a battery pack management unit (BAU), and its current, voltage, and temperature detection units. The BMS system has functions such as high-precision detection and reporting of analog signals, fault alarms, uploading and storage, battery protection, parameter settings, active equilibrium, battery pack SOC calibration, and information exchange with other devices. BMS parameters areas follows：

Table 5.3-1 BMS parameters

NO.	Name	Describe	Remarks
1	Supply voltage	24Vdc	External power supply
2	Equilibrium mode	active equilibrium	N.A
3	Voltage acquisition	±0.3%	N.A
4	Current acquisition	±0.2%	N.A
5	Temperature acquisition accuracy	±1℃	N.A
6	SOC precision	≤8%	N.A
7	Voltage acquisition cycle	≤200ms	N.A
8	Current acquisition cycle	≤50ms	N.A
9	Temperature acquisition cycle	≤5s	N.A
10	Alarm protection	Overcharge, over discharge	PCS EMS
		temperature and short circuit	Support the communication protocol of domestic mainstream PCS and EMS equipment
11	Communication mode	CAN, RS485,Ethernet	
12	Communication protocol	CAN2.0B/modbus-RTU/IP	

Table 5.3-2 system control strategy

Alarm level 1 (power reduction requested)	Alarm level 2 (PCS standby)	Protection level 3(relay cutoff)
Singlecell overcharge/overdischarge alarm;single cell voltage difference alarm; single cell charge / discharge high temperature / low temperature alarm; temperature difference alarm; total voltage high / low alarm; charge /discharge current high alarm; insulation low alarm, etc	Single cell overcharge / overdischarge; large voltage difference of single cell; high / low temperature of single cell charge / discharge; large temperature difference; high / low total voltage; high charge/ discharege current; low insulation	Overcharge / overdischarge of single cell, large voltage difference of single cell, high / low temperature of single cell charging / discharging, large temperature difference of total voltage, overvoltage / undervoltage charging / discharging overcurrent protection. Low insulation, communication timeout, cell failure, NTC failure, etc

6. Electrical cabinet

There is a total of 1 convergence cabinet in the container, the upper level of the convergence cabinet is for AC power distribution and communication function, configured with each switch of auxiliary power, HMI, UPS & battery (30min), switchboard, auxiliary power metering meter (at the inlet of 380Vac in the convergence cabinet), convergence function, 10 battery clusters converge to the input DC busbar, enter through the circuit breaker and then connect to the PCS.

Power distribution function

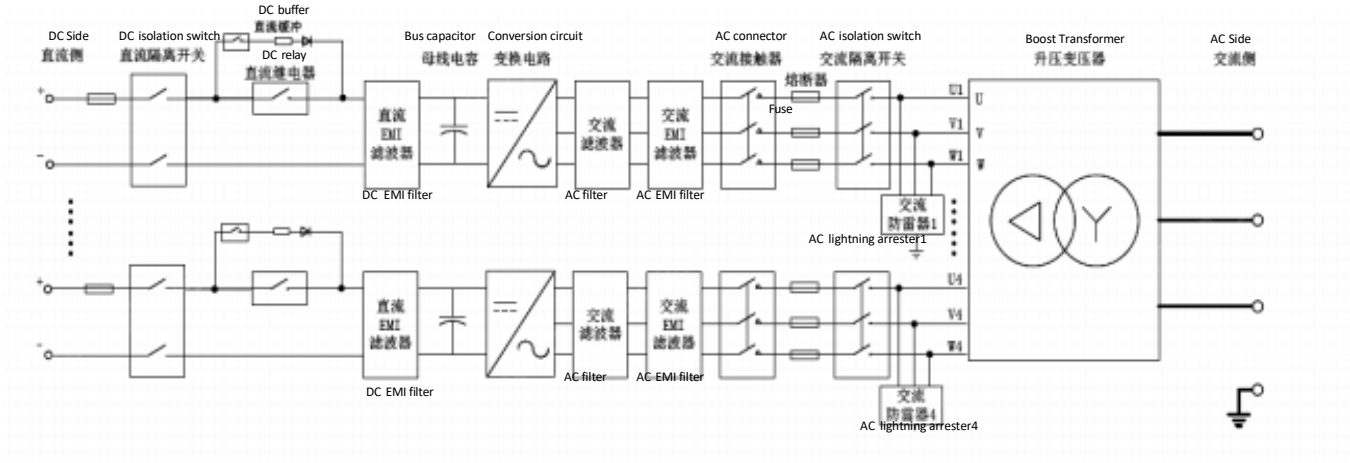
The battery compartment power distribution requires the use of three-phase five wire power supply, which can provide independent control power and 220V single-phase AC power supply for AC electrical equipment such as lighting, UPS, switch power supply, fire protection, temperature and humidity sensors, sockets, etc. inside the battery compartment.

Electrical interfaces include but are not limited to the following interfaces:

1) Control the power supply main circuit breaker (3P5W),
2) The three-phase power supply of the water cooler is 400VAC, with one 3L+PE;
3) 220VAC power supply for lighting and socket, several;
4) UPS input power supply 220VAC power supply;
5) BMS auxiliary 220VAC power supply (provided by UPS);
6) Fire auxiliary 220VAC power supply (provided by UPS);
7) Switching power supply input power supply 220VAC power supply (provided by UPS);
8) Explosion proof fan 220VAC power supply (provided by UPS);
9) Control board power supply (provided by switch mode power supply);
10) Relay control power supply (provided by switching power supply);
11) Touchscreen power supply (provided by switch power supply);
12) Electric louvers, temperature and humidity, smoke sensing, temperature sensing, combustible gas, water immersion 24V power supply;
13) The auxiliary switch is required to be controlled by BAU with shunt excitation;
14) Lighting should be installed inside the cabinet, and the lights should be turned on as soon as the door is
opened.

7.Boost inverter integrated cabin

The topology diagram of bidirectional converter is as follows:



7.1 Parameter Table for Boost Inverter Integrated Cabin

3450kW boost inverter integrated cabin, each 3450kW boost inverter consist 2 set of 1725kW PCS, through the transformer output voltage of 10kV or 35kV.

Boost inverter integrated cabin			
1	Maximum efficiency	98.5%	N.A
2	IP grade	IP54	N.A
3	Allowable ambient temperature	-20~60℃	N.A
4	Cooling mode	air cooling	N.A
5	Relative humidity	0~100% non-condensing	N.A
6	Max allowable altitude	3000m/10000feet(＞ 3000m/10000feet derating)	N.A
7	Dimension	6058*2600*2600mm	N.A
8	Weight	15T	N.A



The specific boost inverter integrated cabin is subject to the actual product

7.2 PCS –Parameter of Single PCS

The PCS parameter values in the table below are for reference only

Table 7.1 Converter parameters

NO.	Name	Describe	Remarks
1	Model	PWS1-1725KTL	N.A
DC characteristics			
2	Max DC power	1897kVA	N.A
3	DC voltage range	1000~1500V	N.A
4	Max DC current	1612A	N.A
5	DC side buffer	With automatic buffer function	N.A
Output characteristics			
6	PCS Rated power	1725kW	N.A
7	Rated power	3450kVA	N.A
8	Rated grid connection voltage	35kV/0.69kV	N.A
9	Grid connected voltage range	-15%~10% (range can be set)	N.A
10	Rated grid connection frequency	50Hz/60Hz	N.A
11	Connection method	three-phase three-wire	N.A

12	Power factor adjustable range	0.99/-1~1	N.A
13	Grid connected current harmonic	≤3% rated power	N.A
14	Overload capacity	110% long term	N.A
Other features			
15	Maximum efficiency	98.5%	N.A
16	IP grade	IP54	N.A
17	Allowable ambient temperature	-20~60℃	N.A
18	Cooling mode	air cooling	N.A
19	Relative humidity	0~100%non-condensing	N.A
20	Max allowable altitude	3000m/10000feet(＞ 3000m/10000feet derating)	N.A
21	Dimension	2200*2160*1300mm	N.A
22	communication mode	RS485/Ethernet/CAN	N.A
23	communication protocol	Modbus TCP/RTU,IEC104,IEC61850	N.A
24	BMS	Support	N.A



Figure 7 - 1725KVA PCS

8.EMS

The energy management system is the top management system of the energy storage system, which mainly monitors and analyzes the energy storage system and load. Based on the results of data analysis, a reasonable power distribution is formulated. It can monitor the real-time data of the equipment in the system, view the real-time data of the equipment in the form of configuration or list, and control and dynamically configure the equipment through this interface.

According to the load forecasting results, combined with the measured data of the operation control module and the analysis results of the system analysis module, the energy management system determines the coordinated and optimal control strategy of energy storage / load. It mainly includes energy management, energy storage scheduling, and management strategy. The energy management system can operate in the grid connected mode, which not only ensures the power supply reliability of users, but also improves the economy of the system.

The system supports multi-level alarm. The alarm thres hold parameters and thresholds can be set. When the alarm occurs, it can prompt the alarm in time and display the alarm information. When the alarm is eliminated within the alarm delay range, the alarm will not be submitted; When the alarm is generated again within the alarm recovery delay range, no alarm recovery information will be generated.

The following control functions are supported ：

1) New energy consumption

According to the power consumption situation, the stored energy can be used to store a certain amount of limited power when the power is limited; When the power is not limited, use the energy storage system to connect the stored energy to the grid for power generation, reduce the waste energy of the photovoltaic field, and improve the energy utilization efficiency and the economic benefits of the station;

2) Peak cutting and valley filling

That is, according to the peak and valley characteristics of the system load, the surplus light energy can be stored in the low load period, and the power and energy can also be absorbed from the grid; Release the energy stored in the energy storage battery during the peak load period, thus reducing the peak-valley difference of the grid load, reducing the power supply burden of the grid, and to a certain extent, making the output of photovoltaic power generation more stable during the peak load period.

9. Container

1. Containers have excellent ventilation, heat dissipation, insulation, and internal temperature control capabilities. The good ventilation and heat dissipation ability can ensure that the container has sufficient air output, excellent dust prevention system, and excellent air circulation system, ensuring reliable and effective forced ventilation and heat dissipation equipment in the container. At the sametime, when the ventilation system is not working at night, effective protection is provided for the air outlet to prevent small animals, dust and other entry and external wind backflow; Thermal insulation capacity. The container is equipped with a moisture-proof, flame-retardant, and thermal insulation layer with enhanced insulation function and an effective thickness of no less than 50mm, ensuring that outdoor high and low temperatures will not be transmitted to the interior of the container

2. The protection level of the containershall not be lower than IP54 and it shall have unlimited full load lifting strength within its service life.

3. Waterproof: no water accumulation, seepage or leakage at the top of the box, norain at the side of the box, and water seepage if liquid is immersed through the bottom of the box.

4. Insulation: The container wall panels and doors are treated with insulation measures.

5. Corrosion resistance: The container's load-bearing skeleton is coated with corrugated board on the outer wall and insulated composite board on the inner wall.

6. Fire resistance: The container shell structure, insulation materials, and interior and exterior decorative materials are all flame retardant materials.

7. Sand resistance: The container has asand resistance function.

8. Shockproof: Before leaving the factory, containers must undergo lifting, load-bearing, and running tests to ensure that the mechanical strength of the container and its internal equipment meets the requirements under transportation and earthquake conditions, without deformation, functional abnormalities, and failure to operate

after vibration.

9. UV protection: The properties of the materials inside and outside the container will not deteriorate due to UV radiation, nor will they absorb the heat of UV radiation.

10. Meet the requirements of dust-proof, moisture-proof, thermal insulation, seismic resistance, lifespan, Etc.

There is a ventilation and heat dissipation system inside the cabin to prevent excessive temperature inside the transformer. The cabin is equipped with a complete heat dissipation, dust and moisture prevention system to prevent high temperature, heavy pollution, and high humidity inside the transformer.

11. The container is equipped with access control alarm function, when someone forcibly tries to open the hatch, the access control generates a threatening alarm signal, and alarms the monitoring background through Ethernet remote communication, and the alarm function can be shielded by the user

12. Cabin lighting

The cabin is equipped with lighting and emergency lighting, and management personnel can manually switch and control the lighting onsite. The lighting has explosion-proof function, providing a safe lighting environment for monitoring inside the container. Install an emergency lighting system inside the container. Once the system loses power, the emergency lighting inside the container will be immediately put into use. Within 5 years, the effective lighting time of a single emergency lighting lamp cannot be less than 2 hours.

10. Fire control

During the storage or operation of batteries, thermal runaway may occur due to the accumulation of heat released from their own chemical reactions or the influence of external heat sources, affecting the safety performance of the energy storage system. In combination with the special requirements of the energy storage system for the fire protection system,a fully automatic and efficient fire extinguishing system has been designed. The system adopts a fully PACK and cabin level fire extinguishing method to ensure that in the event of a battery fire, the fire gas can quickly fill the entire area, submerge the ignition point, and improve the targeted and reliable fire extinguishing system.

The fire protection system consists of a fire detector, controller, storage bottle group, pipeline network, nozzle, pressure relief valve, sound and light alarm, gas spraying indicator light, emergency start stop button, manual automatic switch, etc.

This system adopts the form of a "control center alarm system", with a bus system and a small number of multi wire control methods, with automatic alarm control as the main design principle and manual alarm control as the auxiliary, to achieve alarm and linkage control.

The fire alarm and extinguishing system mainly consists of the following equipment:

(1) Fire alarm controller

The system sets up a fire alarm controller with linkage function according to the requirements, responsible for receiving alarm signals from various detectors in the energy storage prefabricated compartment, as well as status signals from exhaust equipment and fire extinguishing equipment, and controlling the fire prevention and smoke exhaust equipment and fire extinguishing equipment in the entire energy storage prefabricated compartment.

When a fire occurs, the fire extinguishing system, exhaust system, and other equipment in the protected area can be controlled automatically by the setting program in the controller or manually through the buttons set on the panel. The working status of the linkage equipment can be reflected on the controller. When using the set program automatic control method, there is an adjustable delay of 30-60 seconds. During the delay period, manual intervention can be performed to interrupt the output of control commands. The system has manual an automatic switching functions.

Detection section

(1) Functional modules

1) Input module

Used to connect devices such as detectors and pressure switches as switch interfaces to the fire alarm controller according to their addresses, achieving monitoring of the status of the aforementioned equipment.

2) Output module

Used to connect devices such as sound and light alarms as switch interfaces to the fire alarm controller according to their addresses, achieving control over the aforementioned devices.

(2) Detectors

A fire detector is an automatic triggering device of a fire automatic alarm system. This project sets up various types of detectors according to different locations, including point type photoelectric smoke detectors and point type temperature detectors. When a fire occurs within the detection range, it can reliably detect the fire and immediately alert the fire alarm controller.

(3) Manual alarm button

A manual alarm button is installed in the energy storage prefabricated compartment. When the power station duty (guard) personnel discover a fire, they can use this equipment to alarm the fire alarm controller.

(4) Sound and light alarm

Install sound and light alarms outside the energy storage prefabricated cabin, which can receive instructions from the fire alarm controller and emit sound and light alarm signals when a fire occurs.

Firefighting section

Gas fire extinguishing system

The gas fire extinguishing system has three start-up modes: automatic, manual, and mechanical emergency operation.

Automatic start: When the fire alarm controller is set to automatic mode, if there is smoke (or abnormal temperature rise) in the protection area, the smoke (or temperature) detector in the protection area will act and send a fire alarm signal to the fire alarm controller. The fire alarm controller will enter a single fire alarm state and drive the fire alarm bell to send a single fire alarm signal. At this time, the control signal to start the fire extinguishing system will not be issued. As the fire in the protection zone spreads, the temperature continues to rise (or smoke is generated), and the temperature (or smoke) detector in another circuit acts to send another fire alarm signal to the fire alarm controller. The fire alarm controller immediately confirms the occurrence of

the fire and sends a composite fire alarm signal and linkage signal. After a set time delay, the fire alarm controller outputs a signal to activate the fire extinguishing system, and the extinguishing agent is discharged through the transportation pipeline to the protected area for fire suppression. After receiving the feedback signal from the pressure signal, the fire alarm controller will display the air release indicator light outside the protective zone to prevent personnel from entering by mistake. The fire alarm controller can be set in manual mode to only emit a fire alarm signal without generating linkage in the event of a fire.

Manual operation: After the on duty personnel confirm the fire alarm, press the "emergency start" button on the fire alarm controller panel or on-site to immediately start the fire extinguishing system. Press the "emergency stop" button on the fire alarm controller panel or on-site before spraying the fire extinguishing agent, and the fire extinguishing system will not startspraying.

When both automatic and manual start fail, mechanical emergency operation can be carried out in the gas cylinder room to activate the fire extinguishing system.

Ventilation section

Two explosion-proof exhaust fans (with electric louvers) are installed at the end of the prefabricated cabin, and two explosion-proof air intake systems (electric louvers) are installed at the other end of the prefabricated cabin to fully exhaust the interior of the prefabricated cabin before fire action. The explosion-proof fans and louvers meet the requirementsof T/CEC 373-2020 standard for air exchange; PACK

PACK Fire Protection

After receiving afire signal, the BMS will take emergency shutdown measures, including disconnecting the contactor of the battery cluster and the isolation switch of the busbar cabinet.

After determining the occurrence of thermal runaway in the battery pack box, quickly start the fire extinguishing equipment and transfer the fire extinguishing agent through a metal hose to the internal nozzle of the battery pack box,directly reaching the root cause of the fire to implement fire extinguishing. Quickly inert and suppress the expansion of thermal runaway, thereby preventing secondary reignition.

Water fire protection

Prefabricated cabins are equipped with reserved water fire-fighting pipeline interfaces, and pipelines are arranged above the battery rack in the cabin, with a water stop valve installed. In the event of a fire, water can be connected to reduce the temperature inside the prefabricated cabin, effectevely supressing the fire and preventing reignition.



Fig. 10.1 Control logic of fire protection system

11.Packaging, storage, transportation and maintenance

11.1.Packaging

The packaging box of parts and components is marked with the product name, model, quantity, gross weight, manufacturer and contact address, factory date, as well as necessary signs such as "handle with care", "afraid of moisture", "upward", etc., and the signs of packaging, storage and transportation comply with the provisions of GB-191-2000.

11.2.Storage requirements

(1) When the battery pack needs long-term storage, please charge the battery pack to about 50% of the power. The standard charge and discharge current shall be cycled at least once a month, and the small current shall be conducted every three months (0.1C) activate once. Environmental requirements: temperature 25 ± 5 ℃, relative humidity 45% ~ 85%,atmospheric pressure 70kpa ~ 106kpa. Place it in a dry and ventilated place to avoid contact with corrosive substances and away from fire and heat sources.

(2) The battery pack is packed and transported to prevent severe vibration, impactor extrusion during transportation, and to prevent exposure to the sun and rain.

11.3.Transportation requirements

The battery pack should be transported after packaging, and it should be protected from severe vibration, impactor extrusion during transportation, and protected from sun and rain. It can be transported by car, train,ship, etc.

11.4.Maintenance requirements

During maintenance, do not dissect, reassemble or replace the battery in the battery pack by yourself.

11.5.Product identification

Clear high-voltage, positive and negative poles, interface definition symbols, and traceable QR codes of the battery module, battery module and battery system can be seen on the surface of the battery module and high-voltage box

12.Matters needing attention

12.1 It is forbidden to expose the battery to high temperature environment exceeding the temperature conditions specified in this specification for a long time, otherwise it may cause fire; Under any normal use and storage conditions, the temperature of the battery moduleshall not exceed 55 ℃. If the temperature exceeds 55 ℃, the battery management systemshall protect and turnoff the battery, and prohibit the charging and discharging of the battery module.

12.2 It is forbidden to short circuit the positive and negative poles of the battery pack, and connect the positive and negative poles of the battery pack in strict accordance with the marking instructions.

12.3 It is forbidden to immerse the battery pack in water, fire, microwave oven or pressure vessel.

12.4 When electrolyte leakage is found in the battery pack, avoid skin and eyes from contacting the electrolyte. In case of contact, wash the exposed area with a large amount of water and seek help from a nearby hospital. It is forbidden for peolple or animals to swallow any parts of the battery.

12.5 In case of liquid leakage, peculiar smell and abnormal noise during the use of the battery pack, please stop charging and discharging immediately and contact the manufacturer. Do not disassemble and disassemble the battery module without permission, Orient Power does not undertake any product quality assurance for any unauthorized repair or incorrect operation.

12.6 Do not dispose the scrapped battery pack at will, so as to pollute the local environment. Please contact a regular and qualified recycling organization or manufacturer for special treatment.

13. Risk warning

WARNING

CELLS ARE POTENTIALLY DANGEROUS AND PROPER PRECAUTIONS MUST BE OBSERVED IN HANDLING AND MAINTENANCE.

RUNNING TESTS ON THE CELLS IMPROPERLY MAY RESULT IN SEVERE PERSONAL BODY INJURY OR PROPERTY DAMAGES.

WORK ON CELLS MUST BE PERFORMED ONLY WITH PROPER TOOLS AND PROTECTIVE EQUIPMENT MUST BE USED.

CELL MAINTENANCE MUST BE CARRIED OUT BY PERSONNEL KNOWLEDGEABLE OF CELLS AND TRAINED IN THE SAFETY PRECAUTIONS INVOLVED.

FAILURE TO OBSERVE THE ABOVE MAY CAUSE VARIOUS HAZARDS.